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**DATA INPUT DEVICES AND SYSTEMS**  
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4 Claims

## ABSTRACT OF THE DISCLOSURE

An electronic keyboard system composed of completely electronic, capacitive sensing circuits which are responsive to manually actuated, capacitance variations. A plurality of circuit paths are provided, each including an exposed touch member, and energized with bias means such as an RF signal means. Signal variations are introduced by changing the conductance characteristics created by human contact with the touch member. A number of signal channels may be arranged to cooperate with a single sense amplifier that responds to all channels of input sources formed of, for example, a punched card reader and a manual keyboard in accordance with the invention. The use of a single sense amplifier is possible by employing both a column scanning circuit and a row sequencer which scan the card; i.e., the scanning circuit steps through the columns and the signal channels are scanned by the row sequencer. The row sequencer stops upon the detection of a data signal manifestation whereby the position of the row sequencer when stopped is an indication of the numerical value of the hole in the punched card.

This invention relates to systems and devices for providing digitally encoded signals in response to an input condition, and more particularly to manually operated input devices for data processing or communication systems, and to systems using such devices.

Since the advent of modern electronic data processing equipment, rapid and extensive changes have taken place in circuit design and system organization. Consequently, the systems have continually been reduced in size and cost, although at the same time speed and capability have continually increased. Input devices, however, have remained largely unchanged throughout this interval. Thus, for general purpose uses requiring manual data input the systems typically employ an electric typewriter with an associated paper tape puncher and reader. Keypunches and special keyboards are also widely used. These mechanisms are all generally of mechanical construction. Although they are widely used they are complex and have generally proven too costly for those applications involving low data rates or volumes. As computing and data processing systems have been reduced in cost, they have increasingly been able to reach the smaller commercial and professional businesses, and to process most of the data required by such businesses in a fashion far superior to conventional accounting procedures.

The data required to be organized and processed in a small organization such as a medical practice, for example, is of relatively very low volume and generally routine character. Information as to charges, services, and billings can therefore be handled very readily by a data processing system. Accordingly, special purpose computers, time shared systems and various special business services employing data processing systems are increasingly being directed toward handling the routine book-keeping work of small businesses. A crucial factor in the successful operation of any such system, from the standpoint of the user organization, is the expense and difficulty

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involved in data collection. Once adequate data is entered into a modern data processing system the needed financial, statistical or trend data may be extracted and prepared without difficulty. Generally, however, the small organization does not desire to hire or train an individual solely for the preparation of data, and must use personnel whose training and duties are primarily in other fields. The preparation of even small volumes of data can greatly burden a small organization or office unless the data collection function is simply and directly performed.

With the foregoing in mind, there have been devised a variety of input devices for such applications. Most of these devices are now adapted also to transmit data by digital telephone units (such as the "Dataphone"), or direct wire couplings to a data processing system. Most of these input devices are designed to read punched cards, or other prepared media, and also to accept manual input data. Conventional keyboard mechanisms are seldom suitable for these purposes, not only because of cost but also because of size and a need for additional interface equipment. The new and specialized devices, moreover, do not fully satisfy the stringent requirements of cost and simplicity of operation.

Conventional keyboard arrangements tend to be too complex and expensive, even where specially designed solely for decimal data. Specialized manual input devices, such as movable lever arm systems, often are difficult for an untrained operator to use and also do not permit verification of the data which is being entered.

It will be apparent to those skilled in the art that the provision of new manual input devices for data processing systems will not only be of benefit in low cost data collection devices, but will also be applicable to higher speed and higher cost systems. Because error must be reduced to an absolute minimum, the sensing mechanism itself should not be subject to error, in whatever context it is used. The variation between the actuation and non-actuation conditions, for example, must be adequate to discriminate against disturbing factors which may be regarded as system noise. The manual input devices should not only be simple to use and low in cost, but should not change in characteristics over long intervals. They should also provide suitable response to the operator so that errors can be minimized.

It is therefore an object of the invention to provide novel input devices for data processing systems.

Another object of the invention is to provide improved means for entering digital data manually into a data collection system.

Yet another object of the invention is to provide improved low cost data collection systems.

These and other objects in accordance with the invention are achieved by completely electronic capacitive sensing systems which are responsive to capacitance variation manifestations, such as manual actuation. A plurality of circuit paths are defined, each including an exposed touch region, and the circuits are energized with bias means including an RF signal means. Significant signal variations are introduced by changing conductance characteristics created by human contact with the touch region.

Manual input devices in accordance with the invention are completely electronically operated, and therefore have the reliability and long life of electronic systems, and the versatility which electronic design affords. In a specific example of an arrangement in accordance with the invention, a number of individual circuit paths, conveniently provided by printed circuit cards, include key elements which include or are associated with capacitive elements within the circuit path. These capacitive key elements operate by means of a capacity substantially lower than that presented by the human body to ground.